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After total knee arthroplasty, many people are not active enough to maintain their health and fitness: an observational study

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Questions: What proportion of people after total knee arthroplasty adheres to the physical activity regimen recommended for maintenance of health (moderate intensity physical activity for at least 30 min on 5 days/week)? What proportion adheres to the activity regimen recommended to improve fitness (vigorous intensity physical activity for at least 20 min on 3 days/week)? What factors are associated with adherence to these recommendations? **Design:** An observational study. **Participants:** 830 adults who underwent a total knee arthroplasty between 2002 and 2006 at University Medical Center Groningen or Martini Hospital Groningen, the Netherlands. **Outcome measures:** The Short Questionnaire to Assess Health-Enhancing Physical Activity (SQUASH) was used to measure the physical activity behaviour of the participants. These data were analysed as adherence to each recommendation. **Results:** The health recommendation was adhered to by 51% of the participants. The fitness recommendation was adhered to by 53% of participants. Almost half (46%) of the participants fulfilled both recommendations, and 42% did not fulfil either recommendation. Males and more educated participants had higher odds of meeting the health, fitness, and both recommendations. Respondents living with family had higher odds of meeting the fitness recommendation. **Conclusion:** After total knee arthroplasty, 42% of people are not active enough to maintain their health and fitness. Physiotherapists should encourage people with a total knee arthroplasty to undertake the recommended exercise regimens to maintain health and fitness, with particular attention to those people with characteristics known to be associated with poor adherence to the recommendations. [Groen J, Stevens M, Kersten RFMR, Reininga IHF, van den Akker-Scheek I (2012) After total knee arthroplasty, many people are not active enough to maintain their health and fitness: an observational study. *Journal of Physiotherapy* 58: 113–116]

Key words: Total knee arthroplasty, Health, Fitness, Physical activity

Introduction

After a total knee arthroplasty it is important for older adults to become physically active again, to improve not only health but also fitness. Within this context the American College of Sports Medicine (ACSM) proposes that rehabilitation advice after a total knee arthroplasty should turn gradually into tailored life style advice (Nelson et al 2007). In general a rapid improvement in function and exercise capacity takes place during the first months after a total knee arthroplasty. However this improvement plateaus after six months (Kennedy et al 2008) and one year postoperatively patients are considered to be beyond the recovery phase of the operation.

The current physical activity recommendation for older adults (Nelson et al 2007) is similar to the recommendation for adults (Franklin et al 2007), but has differences emphasising the older adult's fitness. Older adults are advised to perform moderate-intensity aerobic physical activity for a minimum of 30 min on five days or vigorous intensity aerobic activity for a minimum of 20 min on three days each week. This first recommendation is based on the 1995 recommendations in which the primary focus was on the improvement of health (Pate et al 1995). The latter recommendation is based on earlier recommendations of the ACSM in which the emphasis was more on the improvement of fitness (Surgeon General 1996). Based on these different emphases, Dutch government agencies distinguish between being physically active at a moderate intensity for a minimum of 30 min on five days, which is called the 'health recommendation', and undertaking vigorous intensity aerobic activity for a minimum of 20

min on three days each week, which is called the 'fitness recommendation' (TNO 2008).

For older adults after total knee arthroplasty, it is important not only to stay healthy but also to be fit. The objective of this study was therefore to determine the proportions of people who meet the health and fitness recommendations after total knee arthroplasty.

Therefore the research questions were:

1. Among the population that has received a total knee arthroplasty, what proportion is physically active at a moderate intensity for at least 30 min on at least 5 days per week?
2. What proportion is vigorously active for at least 20 min on at least 3 days per week?
3. What proportion meets both these recommendations?
4. What demographic characteristics are associated with meeting the recommendations?

What is already known on this topic: Older adults are recommended to exercise for 30 min on 5 days per week to maintain health and to exercise vigorously for 20 min on 3 days per week to improve fitness but the proportion of adults who maintain these exercise regimens after recovery from total knee arthroplasty is not known.

What this study adds: About half of adults at least one year after a total knee arthroplasty do not do enough exercise to maintain their health and improve their fitness. Increased age, female gender, and lower education were associated with inadequate exercise.

Method

Design

An observational study of patients 1 to 6 years after total knee arthroplasty was conducted. The prevalence of adherence to the two recommended minimum exercise regimens was examined using a validated questionnaire about current activity levels, and the factors associated with adherence to the recommendations were examined.

Participants

All patients that underwent a total knee arthroplasty between 2002 and 2006 at University Medical Center Groningen or Martini Hospital Groningen were included. Patients were at least one year postoperative. Exclusion criteria were: dementia, death, poor eyesight, inability to communicate well in Dutch, or recent total hip or knee arthroplasty on the contralateral side.

Outcome measures

Physical activity behaviour was measured with the SQUASH questionnaire (Wendel-Vos et al 2003) which measures habitual physical activity during a normal week over the past few months. The total score is reproduced as minutes per week, but the data can also be analysed according to whether the activity is light, moderate or intense. The SQUASH is reliable and valid in the general population and in persons after total hip arthroplasty (Wagenmakers et al 2008). The proportion of people after total knee arthroplasty that is physically active at a moderate intensity for at least 30 min on five days a week (health recommendation) was calculated from the SQUASH data. These data were also used to calculate the proportion that adheres to the recommendation of vigorous intensity activity for at least 20 min on three days a week (fitness recommendation) and the proportion that adhered to both recommendations. Demographic data were also recorded, including age, gender, family status, and education.

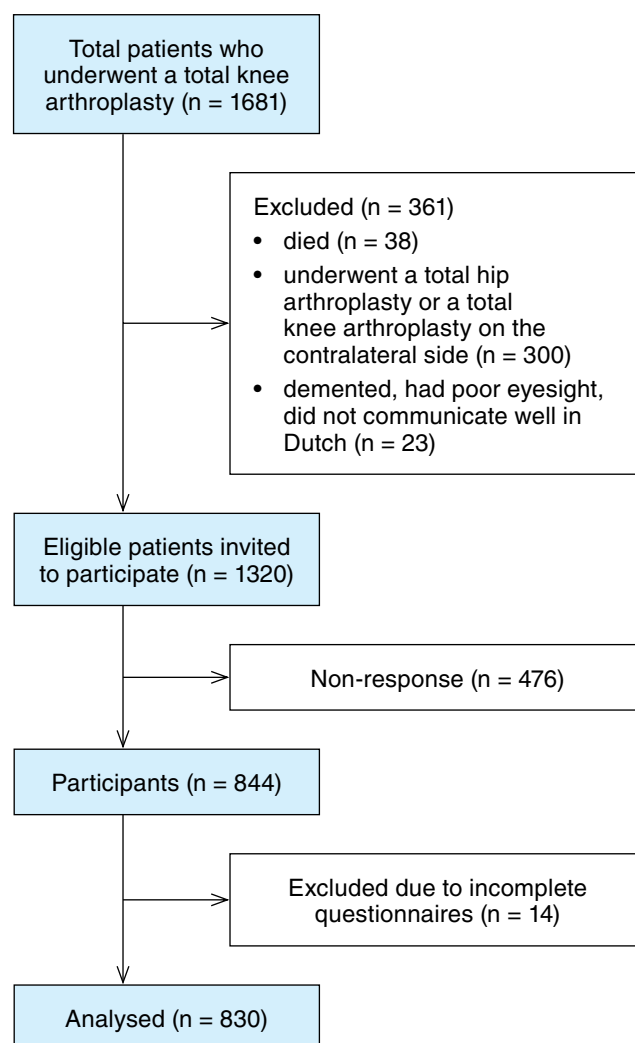


Figure 1. Flow of participants through the study.

Table 1. Characteristics of participants.

Characteristic	Participants				
	All	Subgroups meeting recommendations			
	(n = 836)	Both (n = 384)	Health (n = 426)	Fitness (n = 446)	Neither (n = 348)
Age (yr), mean (SD)	72 (9)	69 (9)	70 (9)	69 (9)	75 (9)
Gender, n (%)					
male	213 (25)	135 (35)	146 (34)	147 (33)	55 (16)
female	614 (73)	246 (64)	277 (65)	296 (66)	287 (82)
missing	9 (1)	3 (1)	3 (1)	3 (1)	6 (2)
Education, n (%)					
lower	482 (57)	192 (50)	218 (51)	234 (52)	219 (63)
middle	267 (32)	132 (34)	153 (36)	157 (35)	96 (28)
higher	70 (8)	42 (11)	47 (11)	47 (11)	19 (5)
missing	25 (3)	12 (3)	8 (2)	8 (2)	14 (4)
Living status, n (%)					
alone	295 (35)	101 (26)	124 (29)	115 (26)	157 (45)
partner/children	528 (63)	277 (72)	296 (69)	326 (73)	184 (53)
missing	13 (2)	5 (1)	6 (1)	5 (1)	7 (2)
Total activity at any intensity (min/wk), mean (SD)	1337 (1260)	2054 (1265)	1970 (1251)	1946 (1254)	573 (816)

Data analysis

Descriptive statistics were used to describe the demographic characteristics and the proportions of participants meeting the exercise recommendations. To determine which of the demographic characteristics (independent variables) were predictive of meeting the health recommendation, the fitness recommendation, and both recommendations (dependent variables), a binary logistic multivariate regression analysis was used. All independent variables (age, gender, education, living situation) were included in the models (enter method). In order to validate the regression models a bootstrap procedure was executed (200 samples). A p value < 0.05 was considered statistically significant.

Results

Flow of participants through the study

From 2002 until 2006, a total of 1681 patients underwent a total knee arthroplasty at University Medical Center Groningen ($n = 316$) or Martini Hospital Groningen ($n = 1365$) because of end-stage primary osteoarthritis of the knee. Because they did not meet the eligibility criteria, 361 patients were excluded: 38 patients had died, 300 had undergone total knee or hip surgery on the contralateral side, and 23 were demented, had poor eyesight, or were unable to communicate well in Dutch. Therefore, 1320 patients were eligible to participate in this study. These patients received a questionnaire and an explanatory letter. A response rate of 64% ($n = 844$) was achieved, of which 830 patients had complete data and were included. The flow of participants through the study is presented in Figure 1. The characteristics of the non-response group were comparable to the group of included patients: 80% women, mean age at time of research 74 years (SD 12).

Participant characteristics

The mean age was 72 years (SD 9). The majority of participants were women (73%). A majority only had some lower form of education (57%). The mean amount of time spent on activities of any intensity was 1337 minutes. Demographic data are presented in Table 1.

Compliance with recommendations

The health recommendation was adhered to by 51% of the participants. The fitness recommendation was adhered to by 53% of participants. Almost half (46%) of the participants fulfilled both recommendations, and 42% did not fulfil either recommendation. Compliance data are presented in Table 1.

Across all participants, the total time spent physically active at any intensity varied from 573 minutes per week to 2054 minutes per week. Participants who adhered to one or both of the recommendations reported a higher amount of physical activity compared to patients who did not comply with either recommendation, as presented in Table 1.

Results of the binary logistic regression analyses show that younger participants, male participants, and participants who had received higher education were more likely to comply with the health recommendation, the fitness recommendation, and both recommendations. In addition, the living situation of the participants was also associated with their likelihood of meeting the fitness recommendation, with participants living together with their family being more likely to comply with the fitness recommendation. The results of the regression analyses are presented in Table 2.

Table 2. Results of binary logistic multivariate regression analyses (odds ratios and 95% confidence intervals).

Predictor	Health recommendation				Fitness recommendation				Both recommendations			
	Original model		Bootstrap estimates		Original model		Bootstrap estimates		Original model		Bootstrap estimates	
	Exp(B)	95% CI	Odds ratio	95% CI	Exp(B)	95% CI	Odds ratio	95% CI	Exp(B)	95% CI	Odds ratio	95% CI
Age	0.95	0.93 to 0.97	0.95	0.93 to 0.97	0.94	0.92 to 0.96	0.94	0.91 to 0.96	0.94	0.93 to 0.96	0.94	0.93 to 0.96
Gender	0.44	0.31 to 0.63	0.44	0.31 to 0.63	0.54	0.38 to 0.79	0.54	0.37 to 0.77	0.48	0.34 to 0.68	0.48	0.32 to 0.70
Education												
lower	–		–		–		–		–		–	
middle	1.53	1.11 to 2.11	1.53	1.14 to 2.12	1.42	1.02 to 1.96	1.42	1.04 to 2.01	1.57	1.14 to 2.16	1.57	1.15 to 2.12
higher	2.00	1.14 to 3.52	2.00	1.04 to 3.83	1.80	1.00 to 3.20	1.80	1.00 to 3.27	1.99	1.15 to 3.50	1.99	1.14 to 3.79
Living situation	1.01	0.72 to 1.42	1.01	0.69 to 1.57	0.70	0.50 to 0.98	0.70	0.50 to 0.94	0.87	0.62 to 1.22	0.87	0.62 to 1.27

In order to determine the predictive value of the patient characteristics age, gender, education and living situation in meeting the health recommendation, the fitness recommendation or both, binary logistic multivariate regression analyses were executed (enter method). Besides the original models, bootstrap models are presented based on 200 bootstrap samples.

Discussion

About half (51%) of the participants adhered to the health recommendation and about half (53%) with the fitness recommendation. Only 46% of the study population adhered to both recommendations. In contrast, 42% did not fulfil any of the recommendations. The results of the binary logistic regression models showed that younger participants, male participants, and participants who had received higher education adhered to the health and fitness recommendations more frequently. The same was true for meeting both the health and the fitness recommendation. In addition, participants living together with family met the fitness recommendation more frequently. By means of the bootstrap procedure, the validity of the predictors selected by the regression models was confirmed.

To our knowledge no literature is available in which research is described to what extent (older) adults who fulfil the recommendation of a minimum of 30 min on five days also meet the recommendation of vigorous intensity aerobic activity for a minimum of 20 min on three days each week. In our study population, 51% complied with the health recommendation. In comparison in the general Dutch population this is 60%. In our study population, 46% complied with both norms, compared to 62% of the Dutch and 49% of the US population (TNO 2008, CDC 2007). More men than women fulfilled both norms, which is in accordance with data from the general Dutch population.

Because 42% of our study population did not fulfil one of the two recommendations, we hypothesise that this group is more prone to health problems, deterioration of their fitness and consequently losing their independence. In view of this, these people should be stimulated to become more physically active. In the latest ACSM recommendations (Franklin et al 2007), it is advised that every older adult should have an activity plan in consultation with a physician or health care provider. With respect to patients after total knee arthroplasty, this means that postoperative therapeutic and preventive recommendations should be integrated into management. With respect to patients after total knee arthroplasty, regular physical activity is associated with improvement in strength, balance, and co-ordination, which has proven to be an effective strategy in the prevention of falls. In the presence of a total knee arthroplasty, falls may result in periprosthetic fracture, implant loosening and/or dislocation of the prosthesis. Furthermore, there are indications that increased bone density due to physical activity improves prosthetic fixation, reducing the risk of loosening. Finally, physical activity might minimise bone loss due to stress shielding, facilitating future revision surgery if needed. On the other hand, preventive recommendations should include not only the stimulation of physical activity but also the education of patients regarding the risks of physical activity associated with a prosthetic knee – in particular the risks of athletic high-impact, high-demand activities (Healy et al 2000.) In general it can be stated that activities with high-peak loading, like running, cause more mechanical loading compared to low- and moderate-impact activities (such as walking, bicycling, and yoga/tai-chi), and may therefore cause more wear of the prosthesis (Stevens et al 2011).

In this study 51% of people at least one year after total knee arthroplasty were physically active for a minimum of 30 min on five days a week and 53% undertook activity of vigorous

intensity for a minimum of 20 min on three days a week. Although 46% complied with both recommendations, 42% did not fulfil either of the two recommendations. In stimulating physical activity emphasis should be laid on this latter group. ■

Ethics: The local medical ethical committees of the University Medical Center Groningen and the Martini Hospital Groningen approved this study. All participants gave written informed consent before data collection began.

Competing interests: None declared.

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